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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A61N 1/02 | A1

(11) International Publication Number: WO 98/05379

(43) International Publication Date: 12 February 1998 (12.02.98)

(21) International Application Number: PCT/US97/14663

(22) International Filing Date: 31 July 1997 (31.07.97)

(30) Priority Data:
08/691,093 1 August 1996 (01.08.96) US

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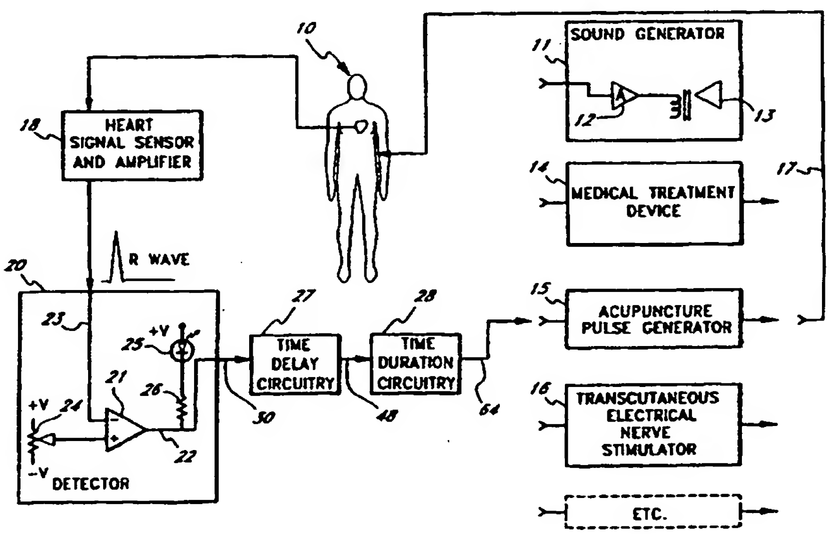
(81) Designated State: JP.

Published
With international search report.

(54) Title: ENERGETIC HEALER - A METHOD AND APPARATUS FOR IMPROVING THE WELL-BEING OF A HUMAN BODY



(57) Abstract

Methods and apparatus are provided for improving the well-being of a human body (10). For the case of apparatus, such apparatus includes a stimulating mechanism (11, 14-16) for stimulating a human body with reoccurring bursts of energy. Such apparatus further includes a sensing mechanism (18, 20) for sensing the heartbeat of the human body and a synchronizing mechanism coupled to the stimulating mechanism, and to the sensing mechanism for synchronizing the stimulation with the heartbeat of the human body by causing the energy bursts to occur at the same rate as the heartbeat of the human body. The synchronizing mechanism includes adjustable time delay circuitry (27) for causing successive energy bursts to occur at the same relative point in successive heartbeat cycles, such point being adjustable so as to occur at a selected position in the heartbeat cycle.

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ENERGETIC HEALER—A METHOD AND APPARATUS FOR IMPROVING THE WELL-BEING OF A HUMAN BODY

DESCRIPTION

Cross Reference to Related Application

The present application claims the benefit of the filing date of copending United States Provisional Patent Application Serial No. 60/016, 109, filed May 6, 1996, entitled "Energetic Healer" and filed in the name of the same inventor as the present application.

Technical Field

This invention relates to methods and apparatus for improving the well-being of a human body. Such methods and apparatus are particularly useful in reducing the pain and discomfort of various human ailments such as headaches, arthritis, rheumatism, back pain and drug and alcohol withdrawal symptoms.

Background of the Invention

The ancient Chinese art of acupuncture is known to relieve various forms of pain and human ailment by the insertion and manipulation of needles at various points in the human body. The traditional theory is that the manipulation of the needles stimulates and restores the flow of "Qi" (natural healing energy) in the human body. More recent medical studies indicate that acupuncture reduces pain by triggering the release of endorphins. which are natural morphine-like chemicals. Such studies further show that acupuncture also stimulates the nervous system to release adrenocorticotropic hormones which aid in fighting inflammation and prostaglandins which help wounds heal faster. In any event, it is well-established that acupuncture does bring relief to many people suffering from various ailments. In fact, the United States Food and Drug Administration has recently decreed that acupuncture needles are as respectable a medical tool as a syringe or a scalpel.

Traditionally, the acupuncture needles have been manipulated by twirling them. A more modern technique which is enjoying widespread usage is to send electrical current through the needles, rather than to twirl them. The electrical current produces the same results as produced by twirling.

A method which is similar to electrically-stimulated acupuncture is a technique which is known as transcutaneous electrical nerve stimulation. This technique reduces the discomfort of chronic pain by sending an electrical current up the spinal cord. This stimulates the brain to send pain-inhibiting impulses back down the spine. Transcutaneous electrical nerve stimulator apparatus is presently used at many hospitals.

Another form of electrical stimulation device is described in United States Patent number 4,865,048, granted on September 12, 1989 to Harold D. Eckerson. The Eckerson device employs a pair of electrodes which are individually placed on the mastoid bone structures located behind the two ears of the patient. A particular electromagnetic waveform

is applied to the electrodes. Studies have shown that the use of this device significantly reduces the physical discomfort associated with drug and alcohol withdrawal treatment.

Summary Of The Invention

In accordance with the present invention, it has been found that the efficiency and effectiveness of body stimulation methods such as those described above can be improved by taking into account the natural rhythm of the human heart. The heart controls the flow of blood to and from the various parts of the human body. Thus, the various body parts and functions are naturally tuned into the cyclic pulsations of the heart. As a consequence, the efficiency of body stimulation methods can be improved by causing the stimulation to be applied in a cyclic manner in step with the beating of the human heart.

To accomplish this purpose, the present invention comprises the steps of stimulating a human body with reoccurring bursts of energy, sensing the heartbeat of the human body and synchronizing the stimulation with the heartbeat by causing the energy bursts to occur at the same rate as the heartbeat.

For a better understanding of the present invention, together with other and further advantages and features thereof, reference is made to the following description taken in connection with the accompanying drawings, the scope of the invention being pointed out in the appended claims.

Brief Description Of The Drawings

Referring to the drawings:

FIG. 1 shows in a schematic manner representative apparatus constructed in accordance with the present invention for improving the well-being of a human body;

FIG. 2 shows a representative form of construction for the time delay circuitry of FIG. 1;

FIG. 3 shows a representative form of construction for the time duration circuitry and some of the stimulating mechanism circuitry of FIG. 1;

FIG. 4 is a portion of an electrocardiogram showing the various phases of a normal heartbeat cycle; and

FIG. 5 is a timing diagram showing some of the signal waveforms occurring during the operation of the time duration circuitry of FIG. 3.

Description Of The Preferred Embodiments

Referring to FIG. 1, there is shown a representative embodiment of apparatus constructed in accordance with the present invention for improving the well-being of a human body. This apparatus includes a stimulating mechanism for stimulating a living human body 10 with reoccurring bursts of energy. FIG. 1 shows four different types of stimulating mechanisms, any one of which may be used to provide the stimulation for the human body 10. The first of these alternative stimulating mechanisms is an acoustical or sound generator 11 for producing bursts of acoustical energy within the hearing range of the human body 10. This acoustical generator or sound generator 11 includes an audio signal amplifier 12 which drives a loudspeaker 13. The loudspeaker 13 is positioned so that the human body 10 may hear the sound waves produced by the loudspeaker 13. These sound waves take the form of sound bursts occurring within the audible range of the human ear. They may, for example, take the form of a melodious beating sound, the beats of which occur at the same rate as the heartbeat of the human 10. If desired, earphones may be used in place of the loudspeaker 13.

A second form of stimulating mechanism which may be used is represented by medical treatment device 14. This medical treatment device 14 may be, for example, a neurostimulator device of the type described in the above-mentioned United States Patent 4,865,048 granted to Eckerson. As such, the device 14 would include a pair of electrodes located at the two ends of a headband which is adapted to hold the electrodes against the mastoid bone structures on the two sides of the head. In accordance with the present invention, the electrical current supplied to the electrodes would be in the form of reoccurring bursts of electrical current occurring at the same rate as the heartbeat of the human patient 10. As indicated in the Eckerson patent, neurostimulation is useful for relieving the pain and discomfort associated with drug and alcohol withdrawal treatment. The present invention, wherein the stimulation is synchronized with the heartbeat, improves the effectiveness of the treatment.

Another form of stimulating mechanism is represented by an acupuncture pulse generator 15, the output of which is connected to an acupuncture needle inserted into the human body 10. The acupuncture pulse generator 15 is effective for delivering heartbeat synchronized bursts of electrical energy to the acupuncture needle.

A further form of stimulating mechanism which may be used is a transcutaneous electrical nerve stimulator 16. This form of stimulating mechanism is in use in numerous hospitals and includes electrodes for sending an electrical current up the spinal cord of the human body 10. In order to obtain the benefits of the present invention, this stimulating mechanism is modified to include a pulsing mechanism for pulsing the operation of the transcutaneous nerve stimulator so that the electrical current is sent up the spinal cord in the form of reoccurring bursts of current which are synchronized with the heartbeat of the human body 10.

An additional form of stimulating mechanism, not illustrated, comprises a light generator for producing bursts of light energy within the awareness range of the human

body 10. By proper selection of the wavelength and intensity of the light energy, the pulsating bursts of light energy produce a soothing effect on the human body 10.

A further type of stimulating mechanism which may be used comprises a touch pressure or body pressure mechanism for applying a mild soothing pressure to the human body in a reoccurring manner in step with the human heartbeat. The pressure may be, for example, in the form of a pat on the back, with the pats occurring at the same rate as the heartbeat.

In most cases, only one type of stimulating mechanism will be used at any given time for the treatment of the human body 10. This is indicated by the plug type connector arrangement shown in FIG. 1. In particular, the output of the time duration circuitry is plugged into the input of the desired stimulating mechanism and, at the same time, the output of such stimulating mechanism is plugged into the connector for a cable 17 which runs to the human body 10. An exception is represented by the case of the sound generator 11 wherein no connection is made to the cable 17. Instead, the loudspeaker 13 is positioned so that it is in the hearing range of the human body 10. In this case, the sound energy is transferred to the human body 10 in the form of radiated sound waves and no electrical connection is required. A similar consideration applies to the case of a light generator stimulating mechanism, in which case light energy is transferred to the human eye in the form of radiated light energy and no electrical connection to the human body is required.

The apparatus of the present invention further includes a sensing mechanism for sensing the heartbeat of the human body 10. In the embodiment of FIG. 1, this sensing mechanism includes a heart activity sensor 18 adapted to detect the cyclic activity of the human heart and detector circuitry 20 coupled to the heart activity sensor 18 for detecting the occurrence of unique points in the heartbeat cycles. The heart activity sensor 18 may include electrocardiogram (ECG) electrodes adapted to be attached to the human body 10 for sensing the electrical currents produced by the activity of the heart or it may include a

stethoscope type acoustical sensor adapted to pick up the sounds of the human heart or it may include a blood pressure sensor adapted to pick up the fluctuations in the blood pressure of the human body.

The detector circuitry 20 of FIG. 1 includes a voltage comparator 21 for producing a negative-going output pulse on line 22 whenever the signal level on input line 23 exceeds a predetermined threshold value as determined by the setting of a potentiometer 24. A light-emitting diode (LED) 25 is connected to the output line 22 by way of a resistor 26. When lit, the LED 25 provides an indication that heartbeat signals are being detected.

When the sensing mechanism uses electrocardiogram electrodes, detector circuitry 20 detects the occurrence of the R wave peaks of the ECG signal. When an acoustical sensor is used, detector 20 detects the occurrence of the peaks in the heart sounds. When a blood pressure sensor is used, detector 20 detects the occurrence of the peaks in the blood pressure fluctuations.

The embodiment of FIG. 1 further includes a synchronizing mechanism coupled to the stimulating mechanism (for example, one of units 11, 14, 15, and 16) and to the sensing mechanism (units 18 and 20) for synchronizing the body stimulation with the heartbeat by causing the energy bursts produced by the stimulating mechanism to occur at the same rate or frequency as the human heartbeat detected by the sensing mechanism. This synchronizing mechanism includes circuitry for producing reoccurring control signal bursts for controlling the activation of the stimulating mechanism, time delay circuitry 27 for determining the position of the control signal bursts relative to the detector output pulses and time duration circuitry 28 for determining the time duration of the control signal bursts.

Time Delay Circuitry of FIG. 2

Referring now to FIG. 2, there is shown a representative form of construction for the time delay circuitry 27 of FIG. 1. As seen in FIG. 2, the detector output pulses produced by detector 20 of FIG. 1 are supplied by way of an input line 30 to a trigger input of a monostable multivibrator 31. Each input pulse on line 30 triggers the multivibrator (MV) 31 to cause it to produce a positive-going output pulse on its output line 32. The duration of each output pulse on line 32 is determined by the resistance value of an adjustable resistor 33 and the capacitance value of a capacitor 34 which are connected to the time constant inputs of the multivibrator 31. In the present example, this time constant value is selected to provide an output pulse duration of approximately 0.775 seconds.

The MV pulses on the output line 32 are supplied to a first input of an AND gate 35. Supplied to the second input of the AND gate 35 are the pulses produced by a 20 Hertz oscillator 36. The period of these oscillator pulses is 50 milliseconds.

For the duration of each MV pulse on line 32, the AND gate 35 is enabled to pass 20 Hertz pulses from oscillator 36 to the "count up" input of a four-bit binary up-down counter 37. The duration of each MV output pulse on line 32 is selected so that 16 oscillator pulses are supplied to the counter 37 for each MV output pulse. Thus, counter 37 counts up to its maximum value of 16 for each MV output pulse and hence for each heartbeat cycle.

The binary-coded output lines QA-QD of counter 37 are connected to the inputs of a 4-to-16 line binary decoder provided by the use of two 3-to-8 line binary decoders 38 and 39. As the counter 37 counts from zero up to its maximum value, the 16 decoder output lines provided by output lines Y0-Y7 of decoder 38 and output lines Y0-Y7 of decoder 39 are momentarily activated one at a time in a sequential manner. a different decoder output line being activated for each different count in the counter 37. For example, for a count of zero in counter 37 the Y0 output line of decoder 38 is activated. for a count of one in

counter 37 the Y1 output line of decoder 38 is activated. for a count of two in counter 37 the Y2 output line of decoder 38 is activated. and so forth. Only one decoder output line at a time is activated, the active line corresponding to the count value in the counter 37.

The Y7 output line of decoder 39 is connected by way of an inverter circuit 40 to the "clear" or "reset" input of the counter 37 to ensure resetting of the counter 37 back to zero at the trailing edge of the activation signal on the Y7 output line of decoder 39.

A particular time delay value is selected by selecting a particular one of the 16 decoder output lines and observing when such output line becomes active. This is accomplished by the use of two 8-to-1 line multiplexers 41 and 42 which are used in combination to provide a 16-to-1 line multiplexer. The 16 output lines of the combined decoder 38-39 are individually connected to different ones of data input lines D0-D7 of multiplexer (MUX) 41 and data input lines D0-D7 of multiplexer (MUX) 42. One of the 16 multiplexer data input lines is selected by internal multiplexer decoding of a 4-bit address signal A, B, C, D which is supplied to selection control terminals A. B, C, and ST of multiplexers 41 and 42. The ST (strobe) inputs are used to choose between the two multiplexers 41 and 42. The desired 4-bit address signal is established by means of a manually settable hexadecimal switch 43. The operator of the FIG. 1 apparatus manually sets the switches in the hexadecimal switch 43 to provide the appropriate coding for selecting the desired one of the 16 possible multiplexer data input lines.

The output lines W of the multiplexers 41 and 42 are connected to the two inputs of an OR gate 44. The output of OR gate 44 is in turn connected to a trigger input of a monostable multivibrator 45. The leading edge of the multiplexer output pulse appearing on the output line of OR gate 44 causes a triggering of the multivibrator (MV) 45. The time duration of each pulse produced by the multivibrator 45 is determined by an adjustable resistor 46 and a capacitor 47 connected to the time constant inputs of the multivibrator 45. Adjustment of the resistor 46 sets the duration of the multivibrator 45 output pulses to have

a value in the range of 1 to 50 milliseconds. The output pulses produced by multivibrator 45 appear on output line 48 and occur at a selected time delay relative to the detector output pulses of detector 20.

The time delay circuitry of FIG. 2 is responsive to the detector output pulses from detector 20 for producing delayed pulses each having a selected time delay relative to its detector pulse. Thus, the reoccurring bursts of energy supplied to the human body 10 for stimulating the body need not occur at precisely the same moment as the peak value in the heartbeat signal. By choosing an appropriate time delay, the burst of stimulation energy can be made to occur at any desired point during each heartbeat cycle. In other words, there will be one stimulation burst for each heartbeat cycle, but such burst need not occur at the peak point of the heartbeat cycle. It can be delayed by the time delay circuitry 27 to occur at any selected point during the heartbeat cycle. The frequency of occurrence of the stimulating bursts, however, remains the same as the frequency or rate of the human heartbeat being sensed.

The first portion of the time delay circuitry 27, which portion includes units 31-44 of FIG. 2, provides a coarse type of time delay which is adjustable in 50 millisecond steps by changing the setting of the switches in the hexadecimal switch unit 43. The last portion of the time delay circuitry 27, which portion is represented by the multivibrator 45, on the other hand provides a fine type of time delay adjustment which is added to the coarse time delay value selected by the hexadecimal switch 43. By adjusting the resistance value of the resistor 46, this added time delay increment can be varied over the range of 0 to 50 milliseconds, which 50 millisecond range corresponds to the time difference between successive coarse delay values selectable by switch 43.

The selected coarse delay pulse appearing at the output of OR gate 44 triggers the multivibrator 45 and the resulting fine delay pulse produced by multivibrator 45 appears on the multivibrator output line 48.

Time Duration Circuitry of FIG. 3

Referring now to FIG. 3 of the drawings, there is shown in greater detail a representative form of construction for the time duration circuitry 28 of FIG. 1. This time duration circuitry 28 is responsive to the delayed pulses produced by the time delay circuitry 27 for controlling the activation of the particular stimulating mechanism which is being used. The delayed pulses from time delay circuitry 27 appear on line 48. The time duration circuitry 28 responds to these pulses to produce the control pulses or control signal bursts which are supplied to the stimulating mechanism. The time duration circuitry 28 includes circuitry for setting the time duration of these control pulses or control signal bursts.

As shown in FIG. 3, the delayed pulses on line 48 are supplied to a trigger input of a further monostable multivibrator 50. Each delayed pulse on line 48 triggers the multivibrator 50 to produce on the multivibrator output line 51 a pulse having the desired stimulation time duration. This time duration is determined by the resistance value of adjustable resistor 52 and the capacitance value of the capacitor 53 which are connected to the time constant inputs of the multivibrator 50. By adjustment of the resistor 52, this time duration can be varied over a range of 1 to 10 milliseconds or longer. Multivibrator 50 is triggered by the trailing edge of each delayed pulse appearing on the input line 48.

The time duration controlling pulses appearing on output line 51 of multivibrator 50 are supplied to a first input of an AND gate 54. Supplied to a second input of the AND gate 54 are oscillator signals produced by an oscillator circuit 55. The frequency of oscillation of the oscillator 55 is adjustable over a range of, for example, 5 kilohertz to 20 kilohertz. During the occurrence of each duration control pulse on line 51, the AND gate 54 is enabled to pass the oscillator signal from oscillator 55 to an AND gate output line 54a. During the absence of a duration control pulse on line 51, this line 51 is at a low level and

the output of AND gate 54 is disabled and no oscillator signals are supplied to the output line 54a.

FIG. 3 also shows a representative form of construction for stimulating mechanism circuitry that can be used for stimulation units 14, 15 and 16 of FIG. 1. this stimulation mechanism circuitry is represented at 49 and includes an amplifier circuit 56 having a transistor 57. The base electrode of transistor 57 is connected to a potentiometer 58 which receives the oscillator signal bursts from the AND gate 54 by way of a resistor 59. Potentiometer 58 is used to control the amplitude of the signal supplied to the body stimulator electrodes. The output circuit for amplifier 56 includes a step-up transformer 60. the secondary winding 61 of which is connected to output terminals 62 and 63. Amplifier output terminals 62 and 63 are, in turn, connected to the cable 17 (shown in FIG. 1) which runs to the human body 10. For the case of stimulation units 14 and 16. cable 17 is connected to the electrodes which are placed in contact with the human body 10. For unit 15, cable 17 is connected to the acupuncture needle or needles inserted into the human body and a current return electrode which contacts the body.

Based on the foregoing, there are several alternatives for supplying the stimulation signals to the human body 10. The particular choice will depend on the construction of the particular stimulation mechanism that is to be used. A first choice is to omit the functions of oscillator 55 and amplifier 56 and, instead, to supply the duration control pulses on multivibrator output line 51 directly to the input of the particular stimulation unit 11. 14. 15 or 16 which is to be used, this being done by way of the connector cable 64 shown in FIG. 1. In some cases, the pulses on multivibrator output line 51 may be applied directly to the cable 17 which runs to the human body 10.

Another choice is to use the oscillator 55 and to supply the oscillator signal bursts on AND gate output line 54a directly to either the input of the stimulation unit or to the

cable 17 which runs to the human body 10. For example. the oscillator signal bursts on line 54a may be applied to the input of sound generator 11 by way of connector cable 64.

A further choice is to use the amplifier circuitry 56 of FIG. 3 and to connect the output terminals 62 and 63 directly to the cable 17 which runs to the human body 10. This would be particularly useful for the case of acupuncture needles where the acupuncture practitioner has no special equipment, other than his acupuncture needles.

Operation of the Preferred Embodiments

The graph of FIG. 4 represents a portion of an electrocardiogram. It shows a complete heartbeat cycle extending from a first R wave peak to the succeeding R wave peak. For the illustrated example, this peak-to-peak time interval is 0.89 seconds. which corresponds to a heart rate of 67.4 beats per minute.

The heartbeat cycle is composed of two major phases, namely, the systole phase and the diastole phase. The systole phase is the contraction phase, while the diastole phase is the relaxation part of the cycle. During the systole phase, the heart muscles associated with the right and left ventricles are contracting to cause a corresponding contraction of the right and left ventricles. Contraction of the right ventricle forces blood through the pulmonary arteries and into the capillaries of the lung. Contraction of the left ventricle forces blood into the aorta and from there to all of the other arteries of the body. During the diastole phase, the heart muscles relax and the blood returning by way of the veins is allowed to flow into the right and left ventricles.

The rhythmatic contraction and relaxation of the heart muscles produce the rhythmatic fluctuations in the blood pressure which are sensed when measuring the pulse rate of a person. The rhythmatic beating of the heart is maintained by an orderly series of electrical current discharges originating in the sinus node of the right atrium and proceeding

through the atrioventricular node to the neuromuscular fibers making up the heart muscles. By attaching electrodes to the appropriate parts of the body, a record of this current can be obtained. This record is called an electrocardiogram and a portion of one such record is represented in FIG. 4. The large peaks occurring at the beginning of the systole phases in the electrocardiogram are commonly referred to as the R waves. When using an electrocardiogram apparatus as the heart sensing mechanism, these R waves are detected by the detector circuitry 20 of FIG. 1. In particular the threshold setting potentiometer 24 for the voltage comparator 21 is set so that only the tips of the R waves are effective to produce the detector pulses appearing on detector circuit output line 30. This amplitude discrimination prevents other parts of the electrocardiogram signal from producing detector output pulses.

FIG. 5 shows some of the signals produced in the time duration circuitry 28 of FIG. 3. Waveform 70 shows some of the pulses produced on the output line 51 of the duration control multivibrator 50. Relative to the electrocardiogram of FIG. 4, the leading edges of these time duration control pulses of waveform 70 occur at desired points in time relative to the peaks of the R waves. The time interval between the occurrence of the R wave peak and the leading edge of the time duration control pulse of waveform 70 is equal to the time delay provided by the time delay circuitry 27 of FIG. 2. Since this time delay is adjustable, the leading edges of the waveform 70 pulses may be cause to occur at any desired point within the period of the heartbeat cycle.

The time of occurrence of the trailing edges of the time duration control pulses of waveform 70 is determined by the RC time constant for the multivibrator 50 and, more particularly, by the setting of the resistance value of the adjustable resistor 52. As indicated in FIG. 5, the time of occurrence of this trailing edge is adjustable to provide the desired duration for the energy burst which is supplied to the stimulating mechanism.

Waveform 71 of FIG. 5 shows the signal appearing on the output line 54a of the AND gate 54 of FIG. 3. The signal bursts shown in waveform 71 have the same time duration as the time duration control pulses of waveform 70. The fluctuations in each signal burst shown in waveform 71 have a frequency determined by the oscillator 55 of FIG. 3. In the present example, this frequency is in the range of 5 kilohertz to 20 kilohertz.

The signal bursts represented by waveform 71 are amplified in the amplifier circuit 56 of FIG. 3 and are supplied by way of amplifier output terminals 62 and 63 to the particular stimulating mechanism being used. For the case of acupuncture needles. for example, the signal bursts of waveform 71 are supplied by way of cable 17 to the acupuncture needle or needles which are inserted into the human body 10.

Since the bursts of electrical energy delivered to the acupuncture needle are produced at the same rate as the human heartbeat, the stimulation of the human body is harmonized with the natural rhythm of the human heart. This pulsed application produces a noticeable improvement in the results of the body stimulation, as compared to the case where the electrical energy is applied in a continuous manner. It is like the case of pushing a child in a swing. The results are much better when the swing is pushed in an intermittent manner in rhythm with the natural back-and-forth period of the swing.

The various circuits shown in FIGS. 1-3 may, for the most part, be provided by the use of commercially available integrated circuit modules. Representative integrated circuit modules which may be used are listed in the following table:

CIRCUIT	IC TYPE	MANUFACTURER
Voltage Comparator	74LM193	National
Binary Counter	74HC193	Toshiba
Decoder	74HC138	Toshiba
Multiplexer	74HC151	Toshiba
Monostable Multivibrator	74HC221	Toshiba
AND Gate	74LS08	Signetics
OR Gate	74HC32	Signetics
Inverter	74LS04	Signetics

While there have been described what are at present considered to be preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention and it is, therefore, intended to cover all such changes and modifications as come within the true spirit and scope of the invention.

CLAIMS

WHAT IS CLAIMED IS:

1. A method of improving the well-being of a human body comprising:

stimulating a human body with reoccurring bursts of energy;

sensing the heartbeat of the human body;

and synchronizing the stimulation with the heartbeat by causing the energy bursts to occur at the same rate as the heartbeat.

2. Apparatus for improving the well-being of a human body comprising:

a stimulating mechanism for stimulating the human body with reoccurring bursts of energy;

a sensing mechanism for sensing the heartbeat of the human body;

and a synchronizing mechanism coupled to the stimulating mechanism and to the sensing mechanism for synchronizing the stimulation with the heartbeat by causing the energy bursts to occur at the same rate as the heartbeat.

3. Apparatus in accordance with Claim 2 wherein the stimulating mechanism comprises an acoustical generator for producing bursts of acoustical energy within the hearing range of the human body.

4. Apparatus in accordance with Claim 2 wherein the stimulating mechanism comprises a neurostimulator device for delivering bursts of electrical current to a selected portion of the human body.

5. Apparatus in accordance with Claim 2 wherein the stimulating mechanism comprises an acupuncture pulse generator for delivering bursts of electrical energy to an acupuncture needle inserted into the human body.

6. Apparatus in accordance with Claim 2 wherein the stimulating mechanism comprises a transcutaneous nerve stimulator for sending an electrical current up the spinal cord of the human body and a pulsing mechanism for pulsing the operation of the transcutaneous nerve stimulator so that the electrical current is sent up the spinal cord in the form of reoccurring bursts of current.

7. Apparatus in accordance with Claim 2 wherein the stimulating mechanism comprises a light generator for producing bursts of light energy within the awareness range of the human body.

8. Apparatus in accordance with Claim 2 wherein the sensing mechanism includes:

a heart activity sensor adapted to detect the cyclic activity of the human heart;

and detector circuitry coupled to the heart activity sensor for detecting the occurrence of unique points in the heartbeat cycles.

9. Apparatus in accordance with Claim 2 wherein the sensing mechanism includes:

electrocardiogram (ECG) electrodes adapted to be attached to the human body;

and detector circuitry coupled to the ECG electrodes for detecting the occurrence of the R wave peaks of the ECG signal;

the synchronizing mechanism being responsive to the detection of the R wave peaks for controlling the occurrence of the energy bursts produced by the stimulation mechanism.

10. Apparatus in accordance with Claim 2 wherein the sensing mechanism includes:

an acoustical sensor adapted to pick up the sounds of the human heart;

and detector circuitry coupled to the acoustical sensor for detecting the occurrence of the peaks in the heart sounds;

the synchronizing mechanism being responsive to the detection of the heart sound peaks for controlling the occurrence of the energy bursts produced by the stimulating mechanism.

11. Apparatus in accordance with Claim 2 wherein the sensing mechanism includes:

a blood pressure sensor adapted to pick up the fluctuations in the blood pressure of the human body;

and detector circuitry coupled to the blood pressure sensor for detecting the occurrence of the peaks in the blood pressure fluctuations;

the synchronizing mechanism being responsive to the detection of the blood pressure peaks for controlling the occurrence of the energy bursts produced by the stimulating mechanism.

12. Apparatus in accordance with Claim 2 wherein the synchronizing mechanism includes:

circuitry for producing reoccurring control signal bursts for controlling the activation of the stimulating mechanism;

time delay circuitry for determining the position of the control signal bursts relative to the peaks in the heartbeat cycles;

and time duration circuitry for determining the time duration of the control signal bursts.

13. Apparatus in accordance with Claim 2 wherein the sensing mechanism includes:

a heart activity sensor adapted to detect the cyclic activity of the human heart:

and detector circuitry coupled to the heart activity sensor for detecting the occurrence of unique points in the heartbeat cycles and producing detector pulses indicative thereof;

and wherein the synchronizing mechanism includes:

time delay circuitry responsive to the detector pulses for producing delayed pulses each having a selected time delay relative to its detector pulse;

and time duration circuitry responsive to the delayed pulses for producing control signal bursts for controlling the activation of the stimulating mechanism, such time duration circuitry including circuitry for setting the time duration of the control signal bursts.

14. Apparatus for improving the well-being of a human body comprising:

a stimulating mechanism for stimulating a human body with reoccurring bursts of energy;

a sensing mechanism for sensing the heartbeat of the human body;

and a synchronizing mechanism including adjustable time delay circuitry coupled to the stimulating mechanism and to the sensing mechanism for causing successive energy bursts to occur at the same relative point in successive heartbeat cycles, such point being adjustable so as to occur at a selected position in the heartbeat cycle.

15. Apparatus in accordance with Claim 14 wherein the time delay circuitry includes:

pulse producing circuitry for producing a predetermined number of timing pulses during each heartbeat cycle;

a pulse counter for counting such timing pulses;

decoder circuitry coupled to the pulse counter for detecting the occurrence of a selected count condition in the pulse counter and producing a decoder output pulse indicative of such occurrence;

circuitry responsive to the decoder output pulses for controlling the activation of the stimulating mechanism;

and selection determining circuitry coupled to the decoder circuitry for selecting the count condition detected by the decoder circuitry.

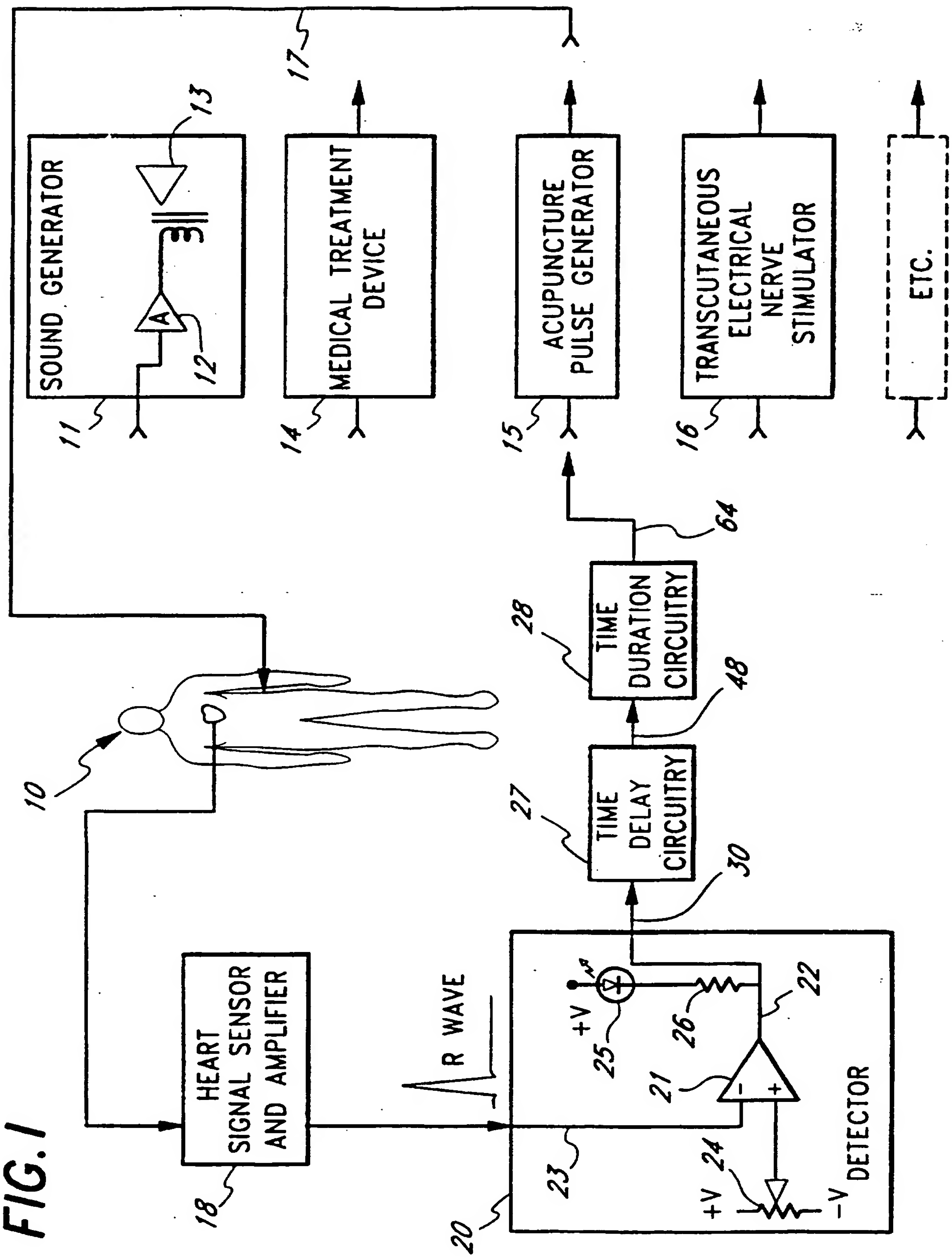

SOUND GENERATOR
A
MEDICAL TREATMENT DEVICE
ACUPUNCTURE PULSE GENERATOR
TRANSCUTANEOUS ELECTRICAL NERVE STIMULATOR
ETC.
TIME DURATION CIRCUITRY
TIME DELAY CIRCUITRY
HEART SIGNAL SENSOR AND AMPLIFIER
R WAVE
+V
-V
DETECTOR
10
11
12
13
14
15
16
17
18
20
21
22
23
24
25
26
27
28
30
48
64

FIG. 1

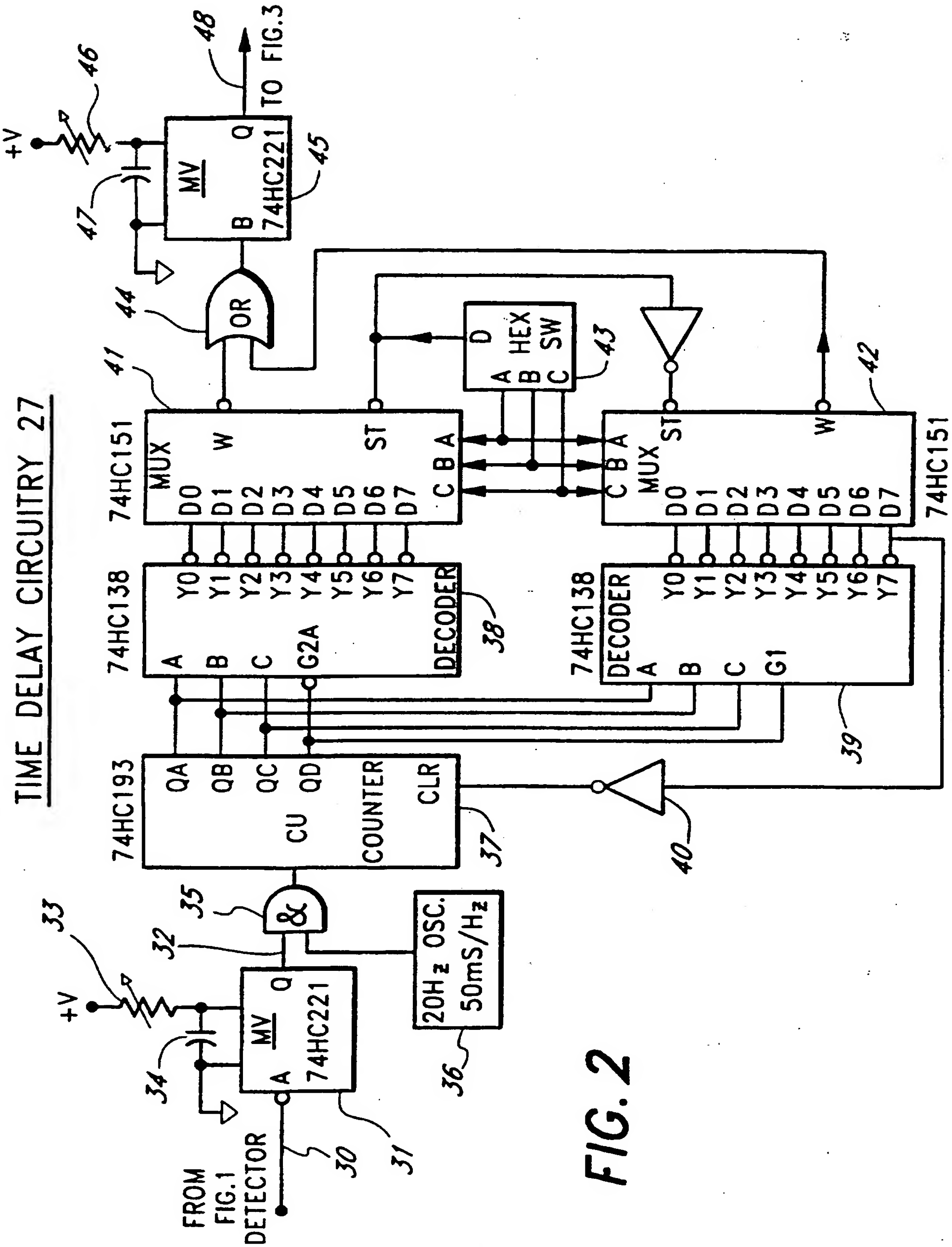
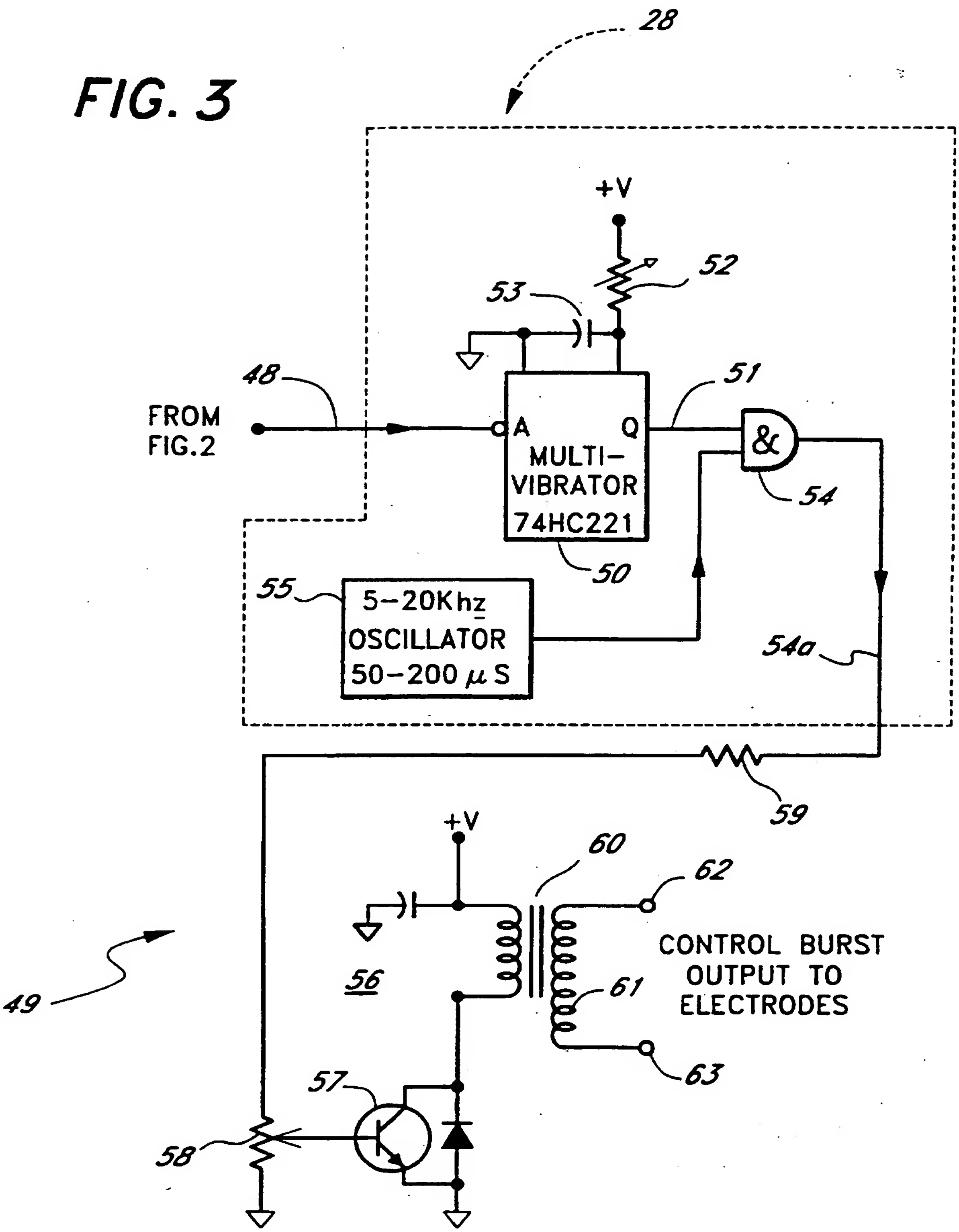

TIME DELAY CIRCUITRY 27
+V
MV
74HC221
B
Q
TO FIG.3
OR
74HC151
MUX
W
ST
D0 D1 D2 D3 D4 D5 D6 D7
C B A
D
HEX
SW
A B C
74HC138
DECODER
Y0 Y1 Y2 Y3 Y4 Y5 Y6 Y7
A B C G2A
G1
74HC193
QA QB QC QD
CU
COUNTER
CLR
&
20Hz OSC.
50mS/Hz
FROM FIG.1 DETECTOR
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48

FIG. 2

FIG. 3


28
+V
52
53
48
51
FROM
FIG.2
A
Q
MULTI-
VIBRATOR
74HC221
&
54
50
55
5-20Khz
OSCILLATOR
50-200 μS
54a
59
+V
60
62
CONTROL BURST
OUTPUT TO
ELECTRODES
49
56
61
63
57
58

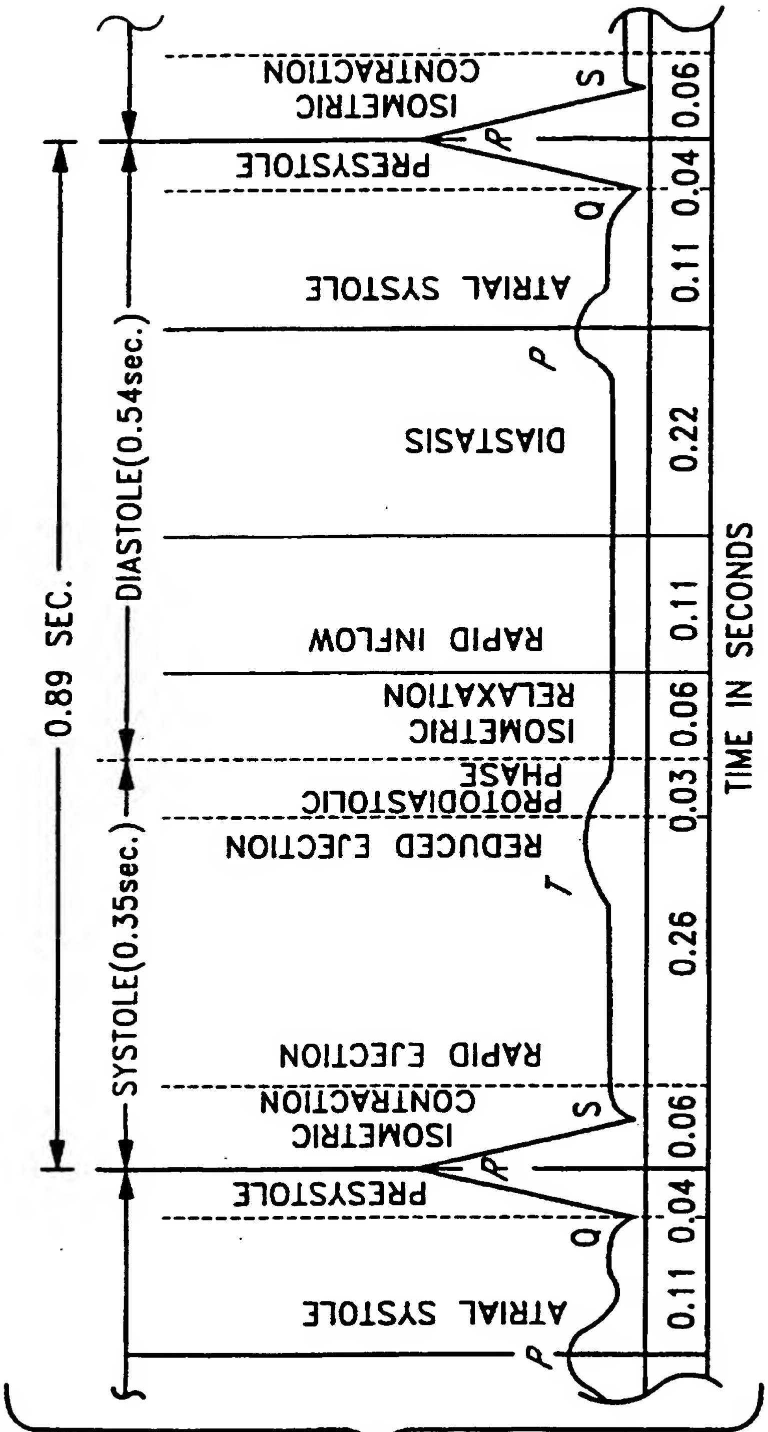

0.89 SEC.
SYSTOLE(0.35sec.)
DIASTOLE(0.54sec.)
ATRIAL SYSTOLE
PRESYSTOLE
ISOMETRIC CONTRACTION
RAPID EJECTION
REDUCED EJECTION
PROTODIASTOLIC PHASE
ISOMETRIC RELAXATION
RAPID INFLOW
DIASTASIS
P
Q
R
S
T
0.11
0.04
0.06
0.26
0.03
0.22
TIME IN SECONDS

FIG. 4

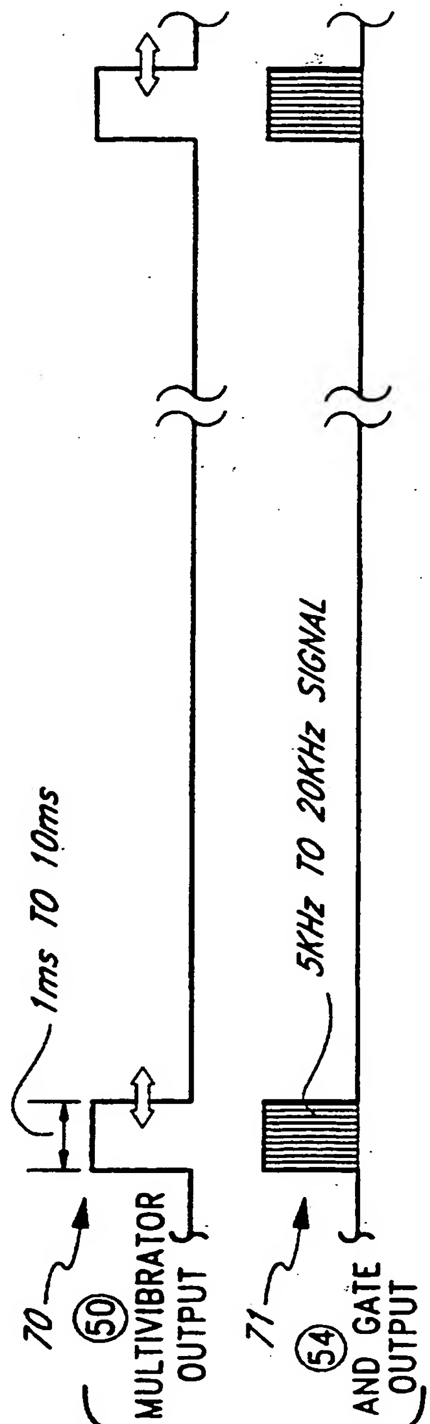

1ms TO 10ms
5KHz TO 20KHz SIGNAL
70
50
MULTIVIBRATOR OUTPUT
71
54
AND GATE OUTPUT

FIG. 5

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US97/14663

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61N 1/02
US CL :607/3
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 128/732, 905, 907; 607/1-3, 88

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	BASON ET AL, Automatic control of the Heart Rate, Proceedings of the IREE, Vol. 33, No. 5, May 1972, pages 231-234, see entire document.	1-3, 8, 9, 12-14 ----------------- 4-6
X	US 4,038,976 A (HARDY et al) 02 August 1977, entire document.	1-3, 7, 10, 11
X	US 4,355,644 A (SAITO) 26 October 1982, entire document.	1-3, 7, 11

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
01 OCTOBER 1997	30 OCT 1997

Name and mailing address of the ISA/US	Authorized officer
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